BUILDING MANAGEMENT SYSTEM

High Performance Green Building (HPGB)
27 June 2015
What Matters in Your Facility

**SAFETY**

**SECURITY**

**COMFORT**

**COST OF ENERGY & OPERATIONS**
BUILDING MANAGEMENT SYSTEM (BMS)
What is BMS

A computer-based control system installed in buildings that controls and monitors a building’s mechanical and electrical equipment such as:

- Air Conditioning
- Ventilation
- Lighting
- Power
- Fire
- Security
Major BMS Manufacturers

- Several manufacturers in the market
- Some manufacturers have different product range / brands
- Different classes / grades of manufacturers
- Choose a reliable System Integrator with proven project track record and strong Manufacturer support
BMS Design 101

- Open System / Protocols
  - BACnet
  - LON
  - MODBUS
  - KNX

- I/O Points and Point Types
  - DO / DI / AO / AI
  - HLI

- Controls
  - On/Off / Interlocks
  - PID

The Integrated Approach

- Reliability
  - Continuity of service of Electrical Power

- Efficiency
  - >30% energy saving Optimised Capex & Opex

- Productivity
  - Productive work places

- Green
  - Connection to renewable energies
BMS Features

- Personalized User Interface
- Graphics
- Schedules
- Trend Logs
- Reports
- Alarm Management
- Web Access
## BMS & GBI

### ENERGY EFFICIENCY (EE)

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
<th>POINTS</th>
<th>BMS Direct Impact</th>
<th>BMS Indirect Impact</th>
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### INDOOR ENVIRONMENTAL QUALITY (EQ)

<table>
<thead>
<tr>
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<th>BMS Direct Impact</th>
<th>BMS Indirect Impact</th>
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<td><strong>3</strong></td>
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HIGH PERFORMANCE GREEN BUILDING (HPGB)
What is HPGB

- Section 1, 2, 3: Purpose, Scope, Definitions
- Section 4: Administration and Enforcement
- Section 5: Site Sustainability
- Section 6: Water Use Efficiency
- Section 7: Energy Efficiency
- Section 8: Indoor Environmental Quality
- Section 9: Atmosphere, Materials and Resources
- Section 10: Construction and Plans for Operation
- Normative References / Appendices A thru F
HPGB Features

- Optimization of Rented m²
- Maximising the Value of Property Assets
- Load Savings
- Optimization of Construction Cost
- Low Consumption / Positive Energy
- Water & Waste
- Health
- Green Mobility / CO₂
- Comfort
- Upgradability / Flexibility
- IT Infrastructure
- Single Smart Card
- Serving the Occupants
- Operations Management
- Safety / Security
- Certification

Economics  Eco-Responsibility  Productivity  Operational Efficiency
HPGB Example – Genzyme Center

Project Type:
- Integrated Building Controls
- Energy

LEED: Platinum

Applications:
- Integrated BMS
- Lighting Controls
- Access Controls
- Fire Alarm Monitoring
- Andover Report Suite

Installed System:
- Schneider Electric - Andover Continuum
- 40,000 Points

Cambridge, Massachusetts, USA
HPGB BMS – Genzyme Center

- BMS lowers operational and energy costs while maximizing natural energy sources such as wind, rain and natural light
- Individual room control for HVAC and lighting via Smart Sensors
- Adjust 900 stainless steel blinds to maximize lighting
- Flushes old air out of the building
- Manages “Living” vegetative green roof
HPGB Benefits – Genzyme Center

- Reduced projected overall energy cost for the building by about 42%, reduced water usage by 34%
- 2 less building technicians required
- Employees sick time reduced by 5%
- 88% employees report improved well being
- 72% report improved alertness and productivity
- Easier recruiting and greater retention of employees
- Enhanced corporate image
BMS TRENDS
IT Adoption

- Network Technologies
- Web Services
- Cloud
- Internet of Things (IOT)
Integrated BMS (iBMS)

The iBMS helps MRCB efficiently operate a Connected Real Estate (CRE). A plan is in the works to transform KL Sentral into the next generation of Malaysian urban centres.

This system helps MRCB combine and fully integrate intelligent diversified buildings using an open platform with real enterprise connectivity and simple web portal thin-client and individually customized user menus.

SUMMARY

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<td>• Elevator</td>
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<td>• Fire Alarm System</td>
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<tr>
<td>• Monitoring</td>
<td></td>
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<tr>
<td>• Management</td>
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</tbody>
</table>
Building Analytics

**Daily diagnostics generate a report containing key facility performance data.**

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**Quarterly Report**

Anon Customer

**Avoidable Energy Cost**

$33,265 Total This Period

$5,201 Decrease Since Last Period

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**Period Trend Summary**

**Energy**
- Daily avoidable energy costs average $377/day.

**Maintenance**
- Priority unchanged: 289 total daily incidents.

**Comfort**
- Priority unchanged: 267 total daily incidents.

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**Facility At A Glance**

- **Customer:** Anon Customer
- **Location:** Mytown, FL 00000
- **Year Built:** 2008
- **Total square footage:** 110,000 sq. ft.

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**Prepared by:**

Joe Partner – Partner Co.
300 Main St., Anytown, MA 00000

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**For the period of:**

October 20, 2013 – January 20, 2014
BMS as a Business Application
HPGB Example
Malaysian Project
Building Management System
Transforming PMO into GBI Platinum

Perdana Putra
The Challenge
Buildings account for 48% of CO$_2$ Emission and 40% of Energy Consumption

Source: http://architecture2030.org
The Vision
“Putrajaya and Cyberjaya will serve as flagship green townships. The Government will take the lead in adopting green building standards. New Government buildings will be designed to meet green standards.

Energy efficiency of existing buildings will be enhanced and as a showcase example, the Prime Minister’s Office complex will be upgraded to meet the Gold Standard Green rating”

Dato' Sri Mohd Najib Tun Abdul Razak, 2010
10th Malaysia Plan speech
The Goal
Non Residential Existing Building (NREB)

GRADING

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<tr>
<th>Score Range</th>
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<tr>
<td>≥ 86</td>
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<tr>
<td>76 to 85</td>
<td>Gold</td>
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<td>66 to 75</td>
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<td>50 to 65</td>
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Building Management System (BMS)
BMS Control Room

Newly Refurbish Control Room – Nerve Center of PMO Facility Management
BMS System Architecture

BACnet Open System Architecture
BMS Workstation accessible from Command Center and Remote Office
Building Dashboards inform & engage PMO occupants in Energy Savings

- Current Month Electrical Consumption: 3,749.73 kWh/h
- Current Month BEI: 2.01 kWh/m²
  - Typical BEI: 20.83 kWh/m² Monthly
- Current Month Water Consumption: 19.40 m³
- Annual BEI: 27.61 kWh/m²
  - Typical BEI: 250 kWh/m² Yearly
- Current Month Chilled Water Cumulative Energy Use: 1,343.00 Tons
- CO₂ Abatement This Month: 468,171.8 kg
- Current Month Renewable Energy Generation: 500.00 kW/h
- Trees Saved This Month: 85,122 trees
BMS used for Continuous Commissioning to keep PMO performing at peak level
Metering

You cannot save what you do not MEASURE!
180+ DPMs for tracking electricity consumption from various Electrical boards
Separate DPMs to track Renewable Energy contribution
BMS monitors Domestic, Kitchen and Irrigation water consumption
High Level Interface to GDC’s BTU Meter to track Chilled Water consumption
Utility Meters monitored by BMS for Reporting and Analysis
Air Conditioning
BMS determines required Room Airflow based on Space Temperature.

Variable Air Volume (VAV)
and modulate VAV Dampers to achieve Airflow requirements
Monitoring of Office Space Temperature from BMS
BMS starts and stops AHU based on optimized Time Schedule
BMS modulates Chilled Water Valve to provide steady Supply Air Temperature
VFD optimizes Fan Speed to maintain Air Pressure in Supply Duct
BMS controls AHU with MDL reducing AHU energy demand during peak loads.
BMS harmonizes PAHU and AHU operations for more efficient cooling

Pre-Cool AHU (PAHU)
BMS controls and monitors synchronization of PAHU with associated AHUs.
Using water as heat transfer media makes Chilled Beams more energy efficient.
Chilled Beams has added advantage of operating with lower noise levels.
Lighting
Balance of Natural Light and LED Lights for Energy Savings
BMS turn on lights only if Daylight Sensors detects natural light is insufficient
Motion Sensors tell BMS to only turn on lights when area is occupied.
Facade Lighting

Awe Inspiring Energy Efficient Façade Lighting System
Outdoor Lighting

Lighting designed to enhance Roof Garden Landscape
Bringing Natural Light to the Inside via Fiber

Parans Lighting
Parans Lighting brings in Natural Light even in enclosed Office Spaces
Lighting Controls viewed from BMS workstation
Renewable Energy

650kWp Building Integrated Photo Voltaic (BIPV)
Provides Shade for Recreational Activities while generating Energy
Indoor Environment Quality

Creating Comfortable & Productive Work Areas with Minimal Energy consumption
Motorised Blinds

Auto adjustment of blinds to suit temperature and lighting preferences
Light Shelves

Allow Light penetration deep into work space while providing window shade
Removes 95.3% air particles which also allow AHU coils to be more efficient
AHU Ultra Violet Germicidal Irradiation (UVGI)

Ultra clean air in the improving general health & wellbeing of building occupants
BMS automatically opens Fresh Air Dampers when CO$_2$ level is high.
Water Efficient Fittings reduces water wastage
Water Recycling

BMS Monitoring of Ablution Water & Condensate Water Recycling
DWM Analysis for potential Water Leakages and Dashboard Display
### Building Energy Intensity (BEI)

<table>
<thead>
<tr>
<th>Year</th>
<th>kWh/m²</th>
<th>Savings</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>2010</td>
<td>138</td>
<td>46.4</td>
<td>34%</td>
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<tr>
<td>2014</td>
<td>91.6</td>
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Water Consumption

2010
133,614 m³ / yr

2014
83,709 m³ / yr

Savings
49,905 m³ / yr

37%
CO₂ Emission Equivalent

2010
7,268,738 kg

2014
5,547,254 kg

Reduction
1,721,484 kg

24%
Future...
The BMS is currently accessible from Control Room in PMO and KFM IOC.
Global Supervision

The Future

All Putrajaya buildings controlled from KFM IOC

Benefit: Better resource utilization with Analytics & Performance Benchmarking